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B. YOUNGBLOOD, DIRECTOR

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DIVISION OF CHEMISTRY

A CHEMICAL STUDY OF VARIETIES OF COTTON SEED

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

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†As of December 1, 1927.
*On leave.
**Dean, School of Veterinary Medicine.
***In cooperation with U. S. Department of Agriculture.
****In cooperation with the School of Agriculture

SYNOPSIS

A comparative study of seventy-three varieties of cotton seed was made co-operatively by the Division of Agronomy of the Texas Agricultural Experiment Station and the Department of Chemistry and Chemical Engineering of the Agricultural and Mechanical College of Texas in order to determine more accurately the chemical differences which might be found in different varieties. The plantings were made on the same date, and each variety was allotted a separate row in a uniform plat.

A chemical study of the seed from these varieties showed that there is no relationship between the weight or size of the seed and the oil content. The seed having the highest percentage of meats and the lowest percentage of hulls carried the highest oil content.

The oil obtained from all varieties gave the same characteristic chemical reactions, indicating that there is no difference in the character of the oil due to the variety.

The protein content of the oil and water-free meats was highest in the seed having the highest oil content.

CONTENTS

A CHEMICAL STUDY OF VARIETIES OF COTTON SEED*

M. T. HARRINGTON, Instructor

This is a chemical study of several varieties of cotton seed which were grown under like cultural conditions during 1926.

There are numerous varieties of cotton on the market today which have been developed to meet certain requirements, and for each of which the originators claim certain distinguishing characteristics and qualities. Experimental work has been conducted at various times by the agricultural experiment stations of the states comprising the cotton-growing section of the United States to distinguish the differences in varieties of cotton.

THE VARIETIES OF COTTON USED

The seed were furnished by D. T. Killough, Agronomist, Cotton Breeding, of the Texas Agricultural Experiment Station, from plants grown as described below. Seventy-three varieties and strains of cotton seed were selected for the study and were planted on a uniform plot of ground on the Main Experiment Station Farm at College Station. The plot of ground used for the test had grown oats the previous year and was plowed on November 14, 1925. The plot was fertilized at the rate of 300 pounds per acre in April, 1926, with fertilizer consisting of two-thirds acid phosphate and one-third cottonseed meal.

The seed were planted May 14, 1926, and one row was used for each variety. The seed were planted by hand in hills three feet apart and the rows were three feet apart, which arrangement allowed uniform space for each plant. In each hill were planted three or four seed, and on June 3, 1926, the plants were thinned out and one plant was left in each hill. The cotton was cultivated five times with a one-row cultivator and two times with a twenty-four-inch sweep. The weeds were hoed out of the rows at intervals of two weeks. The plants were dusted twice with calcium arsenate to kill boll-weevil and leaf-worm. The growing conditions were favorable and good stands of the plants were maintained throughout their growth. There were forty plants in each row.

The cotton was harvested on September 20, 1926. The cotton used for this test was picked from the several end plants on each row and was labeled as to variety; it was also given a sample number and a row number.

The samples were ginned on a small electric saw-gin in the station

*This work was done in the Department of Chemistry and Chemical Engineering, under the supervision of Professor M. K. Thornton in partial fulfillment of the requirements for the degree of Master of Science in Chemical Engineering at the A. and M. College of Texas.

laboratory on November 16, 1926. The ginning percentage was calculated by dividing the weight of the clean lint by the combined weight of the seed and lint and then multiplying the quotient by one hundred. The lint on a number of the seeds, collected at random, was combed out and the length measured.

Since these varieties of cotton seed were grown on a uniform plat of ground and under the same climatic conditions, the only remaining variable was that of variety. There was no apparent difference in growing conditions, in the planting, cultivation, harvesting, or ginning; so, any variation in the analysis or characteristics of the cotton seed should be due to the variety of cotton or to error of sampling. The comparison of the seed from these varieties of cotton was made by means of chemical analyses.

CLASSIFICATION OF VARIETIES

The varieties of cotton used in this study can be placed in seven main groups, which have the distinguishing characteristics shown in Table 1. The length of lint is from actual measurement by Mr. Killough. The other data are compiled from the literature.

Table 1.—Some characteristics of varieties of cotton.

Name	Number of Bolls Per Pound	Percentage of Lint	Length of Lint in Inches
Burnett Group	70— 80	32—35	7/8—1
Delfos Group	75— 90	29—32	1 1/16—1 3/16
Lone Star Group	45— 60	33—40	1—1 1/8
Mebane Group	50— 70	35—40	15/16—1 1/16
Rowden Group	50— 65	32—36	1—1 1/8
Longer Staple Group	80—110	25—33	1 1/8—1 1/2
Miscellaneous	45—110	25—40	7/8—1 3/16

Table 2 contains an outline of the habit of growth of the varieties compiled by Mr. Killough.

Table 2.—Habit of growth of varieties of cotton.

Variety	Height	Length of Internodes	Size of Leaves	Maturity
Burnett	Low-compact	Short	Small	Very early
Delfos	Tall-open	Medium	Small	Early
Lone Star	Medium	Medium	Medium to large	Medium early
Mebane	Medium	Medium to short	Medium to large	Medium early
Rowden	Medium	Medium	Large	Medium early
Longer Staple	Tall-open	Long	Medium to small	Late

Burnett Group includes: Burnett, B-9-1, Westex.

Delfos Group includes: Delfos, Delfos 631, Delfos 1374, Delfos 610?

Lone Star Group includes: Lone Star, Startex, Lankhart, Russell.

Mebane Group includes: Anton, Blue Wagon, Cliett, Harper, Kasch, Mebane, Mueck, New Boykin.

Rowden Group includes: Belton, Rowden, Sunshine.

Longer Staple Group includes: Deltatype Webber, Express, Lightning Express, Pima, Sea Island, Snowflake, Wacona.

Miscellaneous includes: Acala, Bank Account, Cokers Delta, Cook, Durango, Greer, Half and Half, Ingold, King, New Roberts, Piedmont Cleveland, Sartartia Acala, Toole, Truitt, Trice, Wannamaker-Cleveland, D. P. L., Wilson-Cleveland.

DESCRIPTION OF VARIETIES

The following descriptions of varieties are compiled from the literature:

Acala (5) (Medium-boll, medium-staple group): This variety was developed from seed obtained at Acala, in the State of Chiapas, Southern Mexico, in 1906, by G. N. Collins and C. B. Doyle. The present strain was developed from a selection of twenty plants made by Dr. D. A. Saunders, in 1911, from an original field grown at Waco, Texas. Acala is grown extensively in Oklahoma, Texas, and western Arkansas. The plants are of medium height, with strong, erect main stem, few vegetative limbs; fruiting branches short-jointed; upper branches short, lower branches long; dark green leaves of medium size; bolls of medium size with short, blunt points; burs often pendant, stormproof; fifty to fifty-five bolls per pound; length of lint, 1-1/16 to 1-3/16 inches; staple extra strong and with good drag; percentage of lint, 32 to 35.

Boykin (6) (Big-boll, medium-staple group): This variety is not grown extensively at present but was originated by W. L. Boykin, Kaufman, Kaufman County, Texas.

The plants are large and stocky; fruiting branches long-jointed, late-maturing; bolls large, majority five-locked, stormproof, but easily picked; lint of good length, seed large, fuzzy, brownish-gray; fifty bolls per pound; seed per pound, 3,280; length of lint, 1-1/32 inches; strength of fiber, 5.2 grams; percentage of lint, 34.

Burnett (Small-boll, medium-staple group): This variety was originally developed by Mr. O. B. Burnett at Memphis, Texas, about 1900, at the time when this northwest portion of Texas was not a cotton-growing country. He abandoned the work, however, and the Experiment Station at Lubbock, Texas, in 1914, obtained some of the seed and have grown and increased the variety since this time. This variety is high-producing for this part of the country.

The plant is low and open; small leaves; joints of fruiting branch short; small seed with a green fuzz; very early-maturing and not storm-resisting; staple length 15/16 inch; 81 bolls per pound; percentage of lint 33 to 34.

Cleveland (7) (Round-boll, short-staple group): This variety was developed by J. R. Cleveland, Straton, Mississippi, by twenty-five years

of mass-selection work. The variety came into prominence about 1890. It is not grown extensively at present, having been supplanted largely by strains developed from it, as Wannamaker Cleveland, Piedmont Cleveland, etc.

Plants are not uniform, being both semicluster, and open in growth; joints of fruiting branches short, making the variety medium-early maturing; bolls large, not stormproof; seed medium large, fuzzy, light brownish gray; about 60 bolls per pound; 3,100 seeds per pound, lint length, 15/16 inch; strength of fiber, 5.5 grams; percentage of lint, 35 to 37.

Wannamaker Cleveland (7) (Round-boll, short-staple group): This strain of Cleveland was developed by the plant-to-row method of W. W. Wannamaker and Sons, of Saint Matthews, South Carolina. The work was started in 1908 but the seed were not placed on the market in a commercial way until 1916. It is earlier and more prolific, has smaller bolls, and is lower-growing and more spreading than the parent variety. It is widely grown in hill-land districts east of the Mississippi River and to some extent in Arkansas and Louisiana.

The plants are of medium height with medium foliage. The bolls are rounded with very blunt tip, sixty to sixty-nine per pound; 35 to 37 per cent lint; $\frac{7}{8}$ to 1 inch lint.

Piedmont Cleveland (7) (Round-boll, short-staple group): This is a strain selected from Cleveland Big-Boll by J. O. M. Smith and J. N. Collins, of Commerce, Georgia. It resembles the parent strain in habit of growth, but is earlier, more uniform, and more prolific.

Cook or Cook's Improved (6) (Round-boll, short-staple group): This variety was originated by J. R. Cook at Ellaville, Georgia, in 1895. This is a medium-to-large-bolled variety, yielding a high percentage of lint and is medium early. Selections made by the Alabama Experiment Station have replaced the parent strain of Cook to a large extent.

The bolls are round; seed medium in size; fuzzy, greenish or brownish-gray; not stormproof and susceptible to boll rot; bolls per pound, sixty to sixty-five; 4,000 seed per pound; length of lint, $\frac{7}{8}$ inch; strength of lint, 6.8 grams; percentage of lint, 38.5.

Delfos 6102 (7) (Small-boll, long-staple group): This variety sprang from a single outstanding plant selected in a field of Foster-120 at the Mississippi Delta Experiment Station, in 1916, by H. B. Brown. It is grown most extensively on alluvial lands in Mississippi, Louisiana, and Arkansas.

Delfos 6102 is very early and very prolific; it has a low-spreading open plant, with slender main stem and branches; the fruiting branches are long and numerous; leaves are small, having a pale-green color; bolls are narrowly ovate, short-pointed, four- and five-locked, open well, pick fairly well, and run seventy to eighty per pound of seed cotton; percentage of lint, 31 to 32; length of staple, $1\frac{1}{8}$ to 1-3/16 inches.

Delfos 631 (7) (Big-boll, long-staple group): This variety arose from an individual plant selection made at the Mississippi Delta Branch Experiment Station, in 1916, by H. B. Brown. It is not grown as extensively but in the same regions as Delfos 6102.

The plants are erect, of medium height, and rather open; leaves are small to medium in size; bolls are rather long, ovate, long-pointed, running sixty-four to seventy per pound; bolls open well, are fairly stormproof, and pick well; length of lint, 1-3/16 to 1¼ inches; percentage of lint, 30 to 31.5.

Express (7) (Small-boll, long-staple group): This variety was developed from a single plant selected by Dr. D. N. Shoemaker from a mixed field of so-called "Bohemian" cotton growing near Paris, Texas, in 1904. This plant is early and prolific, but is not used a great deal in Texas since it is not stormproof, does not have large bolls, and is lacking in drought-resistant qualities and high lint percentage. E. C. Ewing introduced this variety into the Mississippi Delta in 1911, and it has spread over this entire section and in neighboring states. However, Delfos has been displacing it since 1920.

The plants are very distinct in appearance, tall, pyramidal, open and somewhat spreading; stem and branches long with long internodes; fruiting limbs somewhat short-jointed; leaves small to medium, light green in color; bolls rather small and long; seed small, covered with grayish-green fuzz; bolls per pound, seventy-three to seventy-eight; seeds per pound, 3,900; length of lint, 1-3/16 inches; lint percentage, 28 to 29.

Express 350 (7) (Small-boll, long-staple group): This strain is from a selection made by E. C. Ewing in 1913 and differs from the parent plant in that the plants are shorter and more compact, more prolific, and more uniform.

Lightning Express (7) (Small-boll, long-staple group): This strain was developed from Express 350 by the Pedigreed Seed Company, Hartsville, South Carolina, and differs from it by having a slightly higher lint percentage and more uniform plants.

Half and Half (7) (Round-boll, short-staple group): Half and half was originated by H. H. Summerour, of Duluth, Georgia, in 1904. Cook was the parent strain. Many cotton buyers object to Half and Half because of its short lint, but it has a very high percentage of lint, which makes it popular with many growers. It is grown extensively in hill-lands east of the Mississippi River, and to some extent west of it.

The plants are medium early, rather compact; leaves of medium size; bolls rounded, about seventy-five per pound; lint length, ⅝ to ⅞ inch; lint percentage, 40 to 44.

King (6) and (7) (Early small-boll, short-staple group): T. J. King, formerly of Louisburg, North Carolina, and later of Richmond, Vir-

ginia, discovered a very prolific stalk of cotton in his field of Sugar Loaf in 1890, and from this stalk, he developed what he called King, or King's Improved. Some years afterward he sent seed of the Sugar Loaf variety and of his new improvement to several experiment stations, and the reports convinced him that his new strain was practically identical with the parent variety. This variety is sold under the names King's Improved, King's Early, Mascot, Greer, Spotted Bloom, Ninety Day, and Little Texas.

Sugar Loaf (6) (Early small-boll, short-staple group): This is an old variety which has been grown in North Carolina for many years. Selections from Sugar Loaf are being grown rather extensively at present in the southern and eastern sections of the cotton belt. The variety and its derivatives are characterized by blooms with red or purple spots at the base of the petals.

The plants are slender; leaves medium to small in size; bolls small, three-, four-, and five-locked, the majority four-locked; seeds small, covered with a short fuzz, brownish-gray in color; bolls per pound, ninety-three; seeds per pound, 5,600; average length of lint, 29/32 inch; percentage of lint, 35.

Lone Star (8) (Big-boll, medium-staple group): This variety was developed by Dr. D. A. Saunders from a single superior plant found in a field of Jackson Cotton in the Colorado River bottom, near Smithville, Texas, in 1905. It is being grown extensively at present in Arkansas, Oklahoma, and Texas.

The plants are of medium height with one to four basal vegetative limbs; main stem short-jointed; fruiting branches numerous, long, medium short-jointed; leaves medium to large, very dark green; bolls very large, round, with very short, blunt points; bolls per pound, thirty-five to forty-five; fiber very strong; length of lint, 1 to $1\frac{1}{8}$ inches; lint percentage, 38 to 40.

Rowden (6) (Big-boll, medium-staple group): This variety was developed from Bohemian Cotton by Rowden Brothers, at Wills Point, Van Zandt County, Texas, about 1890. It is medium early in maturity. It is still a very popular variety in Texas, Oklahoma, and parts of Arkansas.

The plants are vigorous and stocky in growth; fruiting branches vary in length from two feet at the base to six inches on upper part of plant; joints regular and of medium length; bolls large and hang downward when ripe, giving the cotton some protection from the weather; seeds large, fuzzy, grayish-white in color; bolls per pound fifty to sixty, seeds per pound 3,360; average length of lint, 15/16 inch; strength of single fibers, 6.3 grams; percentage of lint, 35.4.

Russell (6) (Big-boll, medium-staple group): This variety is also known as Big Boll Green Seed and Ozier Big Boll. It was originated in 1895 by J. T. Russell from an individual stalk found in a field of mixed Truitt at Alexander City, Oklahoma. This variety was widely

grown throughout the cotton belt in 1907, but has recently been supplanted by other varieties.

The plants are large-growing, vigorous; fruiting branches long; joints of medium length; leaves large; bolls large, four- to five-locked; fairly stormproof; the burs very thick; seeds large, covered by a dark-green fuzz; bolls per pound, fifty-six; seeds per pound, 3,100; length of lint, 31/32 inch; strength of single fibers, 5.5 grams; percentage of lint, 30.9.

Toole (6) (Medium-late, small boll, short-staple group): This is a standard strain of Peterkin developed by W. W. Toole, Augusta, Georgia. It is wilt-resistant and is grown in Georgia and other districts when cotton wilt is troublesome. The plants are similar to Peterkin, but with a slight tendency to semicluster.

The bolls are larger than those of Peterkin, fifty per cent five-locked; seeds small, fuzzy, light brownish-gray; bolls per pound, seventy-three; seeds per pound, 5,110; average length of lint, 13/16 inch; strength of single fibers, 6.7 grams; percentage of lint, 37.5.

Covington-Toole (7) (Medium-late, small-boll, short-staple group): This strain is a selection from Toole, made by W. F. Covington, Headland, Alabama. It shows a decided resistance to wilt and is planted extensively in the eastern states of the cotton belt on wilty soils.

Trice (5) (Early, small-boll, short-staple group): This variety was developed by Professor S. M. Bain from an individual stalk found on the farm of Luke Trice, near Henderson, Chester County, Tennessee, in 1907. This variety is considered one of the earliest-maturing varities grown today. It is grown extensively in northern parts of the cotton belt, especially in Tennessee, Kentucky, and Missouri.

The plants are two to five feet high, very prolific; fruiting branches numerous, medium in length, and short-jointed; leaves of medium size; light-green bolls, medium to large, ovate, three- to five-locked; seeds medium to small, covered with whitish or brownish tuft; bolls per pound, seventy to eighty; seed per pound, 3,600; length of lint, 15/16 to 1-1/16 inches; percentage of lint, 31 to 33.

Mississippi Station Trice (7): This strain differs from the parent plant in having slightly more compact plants, smaller bolls, seventy-five to eighty-five per pound, and longer lint, 1 to 1-3/32 inches. This variety is very early, a good yielder, and adapted to rich soils free from wilt. It was selected by the Mississippi Experiment Station.

Triumph (6) (Big-boll, medium-staple group): This variety was developed by A. D. Mebane, of Lockhart, Texas, from Boykin stormproof, in 1889. It is grown extensively west of the Mississippi River, especially in Texas, Oklahoma, and Arizona.

The plants differ from Boykin slightly, being earlier in maturity. The bolls and seeds are somewhat smaller and the percentage of lint is much higher. There are fifty-six bolls per pound; seeds per pound,

3,600; average length of lint, 1 to 1-1/16 inches; strength of single fibers, 6.7 grams; percentage of lint, 36 to 38.

Truitt (6) (Big-boll, medium-staple group): This is a standard variety developed by George W. Truitt, of La Grange, Troup County, Georgia, from selections of Wyche. Bolls per pound, 56; length of lint, 29/32 inch; percentage of lint, 34.

Mebane (Big-boll, medium-staple group): This variety of cotton was developed by A. D. Mebane, of Lockhart, Caldwell County, Texas, in 1882, from plants of Boykin variety. He selected those plants which had withstood the effects of a storm. He developed this variety for the quality of being stormproof, drouth-resisting, early-maturing, and at the same time having large bolls and a high percentage of lint.

The plant is short and stocky, with short joints; large bolls, growing one in a place and growing downward, five-locked; bolls, sixty to sixty-five per pound; seed, about 3,500 per pound; length of lint, 1 to 1-1/16 inches; percentage of lint, 38 to 41.

METHOD OF PROCEDURE

The sample of ginned seed and lint from each variety of cotton, as received from the Experiment Station, were in paper sacks on which were written the name of the variety, its number as given by the Experiment Station, and the row number in which it was grown. Each variety was numbered and the samples were designated by these numbers. The seed and lint were placed in glass-stoppered large-mouth bottles, and were labeled according to the number which was given that variety.

The seed were piled on a paper and the pile was quartered. Opposite quarters were then placed together, thoroughly mixed, and then quartered again. Opposite quarters were again taken, thoroughly mixed, and one hundred seeds counted.

Samples of one hundred seeds each were then weighed and the weight recorded. These seeds were then cut in half, with a pocketknife, and the meats or kernels separated from the hulls. The hulls and kernels were weighed separately, and the percentage of meats and hulls calculated. Some of the seeds contained no meat because it had dried out, was immature, or damaged. The number of such seeds was recorded as damaged seed.

The meats and hulls were then dried for five hours in an electric oven, the temperature of which was 102 degrees centigrade. The samples were allowed to cool in a desiccator and were weighed. This was repeated until a constant weight was obtained. The loss in weight was calculated as percentage of water in the sample.

The methods of analysis which were used are those found in the official and tentative methods of analysis of the Association of Official Agricultural Chemists, and Hedges and Bryant's "Laboratory Manual of Agricultural Chemistry." Oil was estimated by extraction with petroleum ether.

Table 3.—Chemical composition of hulls.

Sample—Name	T. S. No.	Hulls					
		% Oil	% Protein	% Crude Fiber	% Water	% Ash	% Nitrogen-free Extract
Acala	8606	.48	2.81	44.30	9.83	2.58	38.00
Acala	8609	.46	1.99	47.41	9.00	2.47	38.67
Anton	8591	.92	4.75	45.46	9.23	2.58	37.06
B–9–1	6314	.39	2.81	44.64	9.21	2.56	40.49
Bank Account	9127	.58	3.43	45.40	9.59	2.71	38.29
Belton	5984	.41	1.99	47.36	8.31	2.67	39.26
Burnett	6314	.44	3.62	43.36	8.92	2.41	41.25
Cleveland	9126	.43	2.43	43.01	9.53	2.48	42.12
Cliett	8594	.50	3.62	47.37	9.53	2.63	36.40
Cokers Delta	9115	.50	5.18	46.93	9.59	2.54	35.26
Cook	8586	.43	2.43	45.75	9.45	2.50	39.44
Cook	8587	.53	2.81	46.44	9.50	2.51	38.21
Covington Toole	9100	.49	3.62	46.76	8.45	2.73	37.95
Delfos	8602	.44	3.62	44.20	9.12	2.59	40.03
Delfos 631	8603	1.05	3.12	47.65	9.16	2.45	36.57
Delfos	9102	.58	2.81	45.75	8.30	2.51	42.05
Delfos	9107	.46	2.81	46.80	8.87	2.75	38.31
Deltatype Webber	9097	.47	3.62	46.23	9.62	2.53	37.53
D. P. L. No. 5	8611	.51	1.99	46.22	9.49	2.54	39.25
Durango	3666	.46	3.43	44.21	9.89	2.57	39.44
Durango	9120	.15	4.31	47.04	9.04	2.46	36.64
Express	9103	.45	2.43	45.26	9.24	2.66	39.96
Greer's A No. 1	9129	.41	2.81	44.50	9.00	2.66	40.62
Greer's Staple B. B	9130	.46	2.43	47.21	9.54	2.60	37.76
Half and Half	8604	.68	4.75	47.77	9.37	2.61	34.82
Half and Half	9096	.50	5.18	41.23	9.27	2.56	41.26
Harper's	8607	.50	3.62	47.93	9.50	2.43	36.02
Improved King	9098	.57	2.81	42.87	9.26	2.43	42.06
Ingold	9111	.51	1.62	45.73	9.43	2.61	40.10
Kasch	8585	.52	4.37	43.98	9.40	2.55	39.18
Lankhart	8593	.53	4.37	43.21	9.58	2.52	39.79
Lightning	9117	.56	3.62	46.42	8.82	2.52	38.06
Lightning Express	9099	.65	2.81	44.00	9.25	2.57	41.09
Lightning Express No. 4	9125	.79	2.37	43.29	9.71	2.59	41.25
Lone Star	8590	.43	2.43	44.02	8.56	2.56	42.00
Lone Star	9131	.48	2.81	47.60	8.82	2.48	37.81
Lone Star	9132	.43	1.62	47.45	9.49	2.45	38.36
Lone Star	9133	.56	2.81	46.72	9.31	2.51	38.09
D. P. L. No. 8	8612	.23	3.12	46.87	9.27	2.60	38.91
Mathis Wilt-Res. Toole	9108	.40	2.81	43.75	8.49	2.58	41.97
Mebane	804	.43	3.62	45.78	9.26	2.56	38.35
Mebane	4120	.53	2.43	44.05	8.54	2.62	41.83
Mebane	9105	.47	1.99	45.78	9.26	2.46	40.04
Mebane	9113	.47	1.99	47.24	9.31	2.50	38.49
Mebane	9135	.51	3.43	46.13	8.41	2.70	38.72
Mebane (Blue Wagon)	8601	.47	2.43	47.49	8.71	2.64	38.26
Miss. Station Trice	8597	.29	2.62	45.32	9.79	2.53	39.45
Mixon Express	9094	.39	1.62	45.25	8.49	2.46	41.79
Mueck	9104	.46	3.62	42.05	9.51	2.43	41.93
New Boykin	8599	.50	2.43	46.51	9.33	2.78	38.45
New Boykin	9134	.50	2.43	47.64	9.68	2.67	37.08
New Roberts	8604	.13	2.43	44.09	9.08	2.47	41.80
Piedmont Cleveland	9124	.12	3.55	45.60	9.80	2.75	38.18
Rowden	8613	.56	4.37	47.20	8.18	2.65	37.04
Rowden	9128	.35	1.62	46.50	9.16	2.50	39.85
Rowden	9128	.51	2.81	46.41	9.00	2.55	38.66
Russell	9166	.59	3.62	46.01	8.82	2.56	38.40
Sartartia Acala	9123	.13	2.37	44.85	9.17	2.51	40.97
Snowflake	8595	.26	2.81	47.21	9.00	2.52	38.20
Startex 333	7000	.48	2.81	43.42	8.55	2.61	42.13
Startex 333	7000	.57	4.37	45.72	9.97	2.61	36.76
Startex 333	7000	.45	3.43	47.06	9.73	2.60	36.73
Sunshine	8596	.56	2.81	46.75	9.18	2.57	38.13
Toole Prolific	9110	.51	3.62	46.78	8.73	2.49	37.87
Trice	9106	.50	1.62	47.22	9.67	2.62	38.37
Trice	9114	.51	3.62	45.07	9.26	2.63	38.91
Truitt	8610	.50	3.62	46.03	9.22	2.49	38.14
Truitt	8610	.85	2.43	45.58	9.41	2.63	39.10
Wacona	8592	.49	2.81	47.38	9.57	2.61	37.14
Wannamaker Cleveland	9101	.52	1.62	46.88	9.19	2.73	39.06
Wannamaker Cleveland	9109	.45	1.62	47.16	9.81	2.66	38.30
Westex	8487	.53	1.62	47.36	9.00	2.70	38.79
Wilson Cleveland	9119	.41	3.43	47.29	9.42	2.66	36.19

Table 4.—Chemical composition of seeds and meats.

Sample—Name	T. S. No.	Per Cent Lint	Length of Lint in Inches	Weight 100 Seeds in Grams	No. Damaged Seed in 100	Per Cent Meats	Per Cent Hulls	Per Cent Oil in Seeds	Meats						% Protein of Oil and Water Free Meats	Per Cent Protein in Seed
									% Oil	% Protein	% Crude Fiber	% Water	% Ash	% Nitrogen-Free Ext.		
Acala	8606	32.5	1-1/32	9.6717	6	48.80	51.20	16.28	32.90	52.43	2.03	6.47	4.59	1.58	86.4	26.9
Acala	8609	32.8	1	11.6457	4	53.00	47.00	18.50	34.52	51.62	1.86	6.13	4.60	1.27	87.0	28.2
Anton	8591	38.9	1	10.5773	1	53.23	46.77	16.48	30.16	52.81	1.83	5.30	4.61	5.29	82.0	30.3
B-9-1	6314	32.6	13/16	9.4238	5	49.61	50.39	15.09	30.00	55.62	1.89	6.24	4.59	1.66	86.0	29.0
Bank Account	9127	32.9	7/8	8.6856	3	53.70	46.30	18.13	33.28	52.43	1.90	7.02	4.90	.47	86.6	27.5
Belton	5984	33.9	1-1/16	11.7431	4	49.48	50.52	14.48	28.83	54.43	1.90	6.24	4.60	4.00	83.9	27.9
Burnett	6314	32.5	15/16	7.6397	3	51.46	48.54	17.60	33.89	53.62	1.92	5.64	4.57	.36	88.6	29.3
Cleveland	9126	31.9	7/8	9.1432	5	50.42	49.58	16.06	31.52	53.62	1.97	6.61	4.71	1.57	86.8	28.2
Cliett	8584	39.3	15/16	9.2515	5	48.00	52.00	15.30	31.38	54.00	1.90	6.22	4.70	1.80	86.7	27.9
Cokers Delta	9115	30.4	7/8	9.2731	4	47.74	52.26	13.80	28.37	51.62	1.90	6.24	4.93	5.63	79.2	27.3
Cook	8586	35.8	3/4	8.8501	2	50.93	49.07	16.94	32.87	51.62	1.90	5.52	4.56	5.53	83.9	27.4
Cook	8587	35.4	3/4	8.4813	6	51.61	48.39	16.16	30.85	51.62	1.86	6.45	4.60	4.62	82.5	28.0
Covington Toole	9100	34.8	5/8	8.2380	3	52.04	47.96	16.25	30.81	52.83	1.79	5.77	4.61	4.19	83.4	28.6
Delfos	8602	30.0	1-1/16	8.5962	3	48.82	51.18	16.93	34.28	52.83	1.93	5.33	4.73	.80	87.5	27.5
Delfos 631	8603	31.5	1-1/8	8.6672	4	50.20	49.80	14.99	28.85	54.43	1.90	5.72	4.73	4.37	83.3	28.7
Delfos	9102	29.2	1-1/8	8.2087	4	45.18	54.82	14.46	31.35	54.43	1.86	5.97	4.56	1.83	86.8	27.1
Delfos	9107	29.7	1-1/8	8.1748	10	48.13	51.87	14.39	29.45	55.19	1.90	5.92	4.52	3.02	85.4	28.0
Deltatype Webber	9097	24.8	1-5/16	8.5213	6	47.07	52.23	14.90	30.92	54.81	1.96	6.04	4.73	1.54	86.9	28.7
D. P. L. No. 5	8611	35.8	7/8	9.3943	0	54.87	45.13	17.63	31.78	52.43	1.93	5.86	4.66	3.34	84.1	29.6
Durango	3666	31.7	15/16	8.6457	2	50.52	49.48	16.15	31.53	55.62	1.91	6.20	4.56	.18	89.3	29.7
Durango	9120	31.2	1-1/16	11.5782	6	55.48	44.52	17.17	30.87	52.56	1.93	5.97	4.51	4.16	83.1	31.0
Express	9103	26.5	1-1/8	8.6602	3	50.10	49.90	16.28	32.09	52.43	1.78	6.33	4.75	2.62	85.4	27.4
Greer's A-No. 1	9129	34.2	13/16	11.6296	3	46.46	53.54	14.17	30.01	53.02	1.86	6.09	4.73	3.68	83.1	26.2
Greer's Staple B. B.	9130	30.9	1-1/8	10.9456	4	48.55	51.45	14.58	29.56	53.62	1.83	6.23	4.51	4.25	83.5	27.4
Half and Half	8604	43.5	3/4	9.5165	4	55.53	44.47	16.00	28.25	50.00	1.76	5.46	4.53	10.00	75.4	29.9
Half and Half	9096	37.2	7/8	8.5258	6	52.98	47.02	18.58	34.67	50.00	1.77	6.36	4.51	2.69	85.0	28.9
Harpers	8607	36.3	15/16	10.8787	3	49.08	50.92	15.15	30.39	55.63	1.93	6.10	4.61	1.35	87.5	29.1
Improved King	9098	32.9	7/8	7.7518	9	46.62	53.38	13.32	28.00	54.81	1.85	6.63	4.66	4.05	83.9	28.0
Ingold	9111	33.6	1	10.1042	11	53.29	46.71	17.74	32.87	52.43	1.80	6.12	4.59	2.19	85.9	29.2
Kasch	8585	39.1	15/16	10.1009	3	49.19	50.81	15.56	31.14	52.83	1.94	6.20	4.82	3.07	84.2	28.1
Lankhart	8593	37.4	1-1/16	11.3365	2	49.09	50.91	16.37	32.82	52.83	2.06	6.04	4.81	1.44	86.3	28.1
Lightning	9117	37.3	7/8	11.0454	2	48.15	51.85	14.89	30.45	54.00	1.87	6.06	4.59	3.03	85.1	27.9
Lightning Express	9099	28.5	1-3/16	8.8877	2	48.41	51.59	14.42	29.15	54.43	1.90	6.32	4.92	3.28	84.2	27.7
Lightning Express No.4	9125	30.2	1-1/8	7.7985	7	47.37	52.63	14.38	29.55	51.72	1.92	5.51	4.63	6.67	79.7	26.7
Lone Star	8590	34.2	1-1/16	9.7305	5	44.00	56.00	15.34	34.35	52.83	1.90	5.34	4.73	.85	87.5	24.9
Lone Star	9131	37.0	1-1/16	12.3810	1	49.55	50.45	16.14	32.15	54.00	1.96	6.14	4.67	1.08	87.5	28.2

Lone Star	9132	36.1	1-1/16	11.9953	3	47.16	52.84	14.96	31.29	53.62	1.81	5.44	4.56	3.28	84.8	26.1
Lone Star	9133	34.7	1-1/16	11.4590	2	51.51	48.49	17.02	32.57	52.83	1.96	5.88	4.55	2.21	85.7	28.5
D. P. L. No. 8	8612	39.0	15/16	8.3461	4	53.66	46.34	14.93	27.60	54.94	2.00	5.73	4.72	5.01	82.4	30.8
Mathis Wilt-Res. Toole	9108	33.6	3/4	7.7335	6	51.38	48.62	15.26	29.30	54.43	1.88	5.74	4.72	3.93	83.7	29.1
Mebane	804	34.8	15/16	9.7188	3	52.51	47.49	17.78	33.46	52.43	1.84	6.04	4.77	1.46	86.6	29.1
Mebane	4120	32.3	1	9.6040	2	51.77	48.23	15.38	29.27	54.81	1.90	5.91	4.86	3.25	84.5	29.4
Mebane	9105	36.6	1	8.5957	7	50.38	49.62	17.58	33.43	52.83	1.77	5.93	4.61	1.43	87.0	27.5
Mebane	9113	37.6	1	8.7598	2	52.41	47.59	17.17	32.39	52.43	1.75	6.00	4.61	2.82	85.1	28.3
Mebane	9135	39.6	1-1/16	12.0073	0	51.60	48.40	17.03	32.55	52.43	1.86	5.78	4.55	2.83	85.1	28.6
Mebane Blue Wagon	8601	37.0	1	11.9342	5	48.45	51.55	15.02	30.55	51.66	2.01	5.91	4.56	5.35	81.4	26.2
Miss. Station Trice	8597	31.1	13/16	8.5715	7	53.70	46.30	15.42	28.45	55.68	1.87	5.78	4.70	3.52	84.8	31.1
Mixon Express	9094	33.2	1-1/16	8.3022	8	46.40	53.60	15.09	32.07	51.62	2.15	6.34	4.61	3.21	83.9	24.9
Mueck	9104	37.2	1	10.2416	6	46.87	53.13	15.54	32.69	51.62	1.91	6.15	4.57	3.06	84.4	26.1
New Boykin	8599	36.8	15/16	8.4440	11	47.70	52.30	14.58	30.00	52.43	.92	6.04	4.52	5.09	82.0	26.2
New Boykin	9134	32.8	15/16	9.3958	3	54.40	45.60	17.80	32.03	51.62	1.97	6.41	4.59	3.38	83.9	29.1
New Roberts	8604	34.0	13/16	9.2012	2	49.15	50.85	15.23	30.85	53.10	1.97	5.95	4.56	3.57	84.1	27.3
Piedmont Cleveland	9124	34.1	15/16	9.5333	9	50.14	49.86	12.86	25.54	52.37	1.86	5.26	4.56	10.41	75.8	27.9
Rowden	8613	31.9	1-1/16	9.8619	8	46.46	53.64	15.36	32.45	51.62	1.97	5.99	4.91	3.06	83.8	26.3
Rowden	9128	32.3	1-1/16	11.8240	0	51.05	48.95	16.02	31.06	52.83	1.83	6.24	4.77	3.27	84.3	27.8
Rowden	9128	34.5	1-1/16	12.6900	1	51.33	48.67	16.70	32.14	53.25	2.02	6.20	4.75	1.64	86.3	28.6
Russell	9166	26.4	1-1/16	9.8860	2	50.28	49.72	15.33	29.94	54.00	1.96	5.96	4.58	3.56	84.3	29.0
Sartartia Acala	9123	34.5	1	10.3288	2	56.09	43.91	16.77	29.82	50.00	1.88	6.03	4.61	7.62	77.9	28.2
Snowflake	8595	26.9	1-1/4	10.5503	2	51.48	48.52	18.57	35.90	50.00	1.91	5.22	4.55	2.42	80.4	27.0
Startex 333	7000	33.3	1	9.8226	6	49.39	50.61	15.66	31.24	53.62	1.86	5.90	4.72	2.66	85.6	27.9
Startex 333	7000	36.5	1	10.3586	4	50.82	49.18	17.00	32.93	53.62	1.94	5.96	4.53	1.02	87.7	29.3
Startex 333	7000	35.4	1	8.9000	8	48.03	51.97	15.20	31.15	55.62	1.93	6.16	4.72	.42	88.8	28.6
Sunshine	8596	32.1	1	9.7673	2	45.39	54.61	14.74	31.58	51.62	1.93	6.32	4.63	3.92	83.3	24.9
Toole Prolific	9110	33.3	13/16	9.3288	4	51.78	48.22	15.30	29.14	52.43	1.93	6.15	4.63	5.72	81.1	28.8
Trice	9106	31.0	1	9.0190	4	48.89	51.11	15.46	31.10	51.62	1.75	6.25	4.52	4.76	82.4	26.1
Trice	9114	38.1	15/16	10.5616	2	50.00	50.00	17.79	33.08	51.62	1.76	6.09	4.59	.86	85.0	27.6
Truitt	8610	33.6	15/16	9.0207	2	49.44	50.56	14.75	29.39	54.43	1.76	6.30	4.61	3.47	84.6	28.7
Truitt	8610	34.0	15/16	12.5702	2	52.34	47.66	17.52	32.14	51.62	1.95	5.92	5.11	3.66	83.5	28.1
Wacona	8592	33.1	1-1/8	10.7329	7	49.18	50.82	14.05	28.13	54.43	1.93	6.29	4.90	4.32	83.0	28.1
Wannamaker Cleveland	9101	33.9	3/4	7.9882	11	43.30	56.70	10.64	23.95	51.62	1.85	6.85	4.83	10.90	74.7	23.4
Wannamaker Cleveland	9109	33.8	3/4	9.1218	1	56.43	43.67	19.30	33.93	51.62	1.79	6.17	4.83	1.66	86.3	29.7
Westex	8487	33.2	7/8	8.2898	6	50.00	50.00	16.50	32.46	52.43	1.95	6.36	4.66	2.14	85.7	27.1
Wilson Cleveland	9119	33.6	13/16	8.6683	4	55.50	45.50	17.14	30.58	53.62	1.86	5.96	4.66	3.35	84.7	31.2

RELATION OF WEIGHT AND SIZE OF SEED TO PERCENTAGE OF OIL

The varieties of cotton seed were grouped according to size of seed, which is indicated by the weight of one hundred seed. Those which weighed over eleven grams were in one group, those which weighed ten to eleven grams in another group, those weighing nine to ten grams in still another group, and those weighing under nine grams in the fourth group.

Table 5.—Relation of weight and size of seed to percentage of oil.

Weight of 100 Seeds	Per Cent Hulls	Per Cent Meats	Per Cent Oil
Over 11 grams	49.7	50.3	16.19
10 to 11 grams	49.4	50.6	16.28
9 to 10 grams	49.9	50.1	15.70
Under 9 grams	49.5	50.5	16.05
Average	49.6	50.4	16.06

The examination of these results shows that the weight or size of the seed has no relation to the percentage of hulls, meats and oil.

The percentage of oil in the seed was averaged for each size of seed. These results are given in Table 5 and the figures show that there was no relation between the size of the seed and the oil content.

RELATION OF COMPOSITION OF OIL TO VARIETY OF SEED

The index of refraction of the oil from each variety of cotton seed was determined by means of the Abbe Refractometer. The index of refraction is one of the best tests to show whether or not there is uniformity and homogeneity between samples. It was found that all the samples of oil gave a reading on the refractometer between 1.4738 and 1.4740 at 20 degrees centigrade. Since there were practically no variations in the readings, this test shows that the oil has a constant composition regardless of the variety of seed from which it is obtained.

The iodine value and the saponification number were determined on the oil from each variety of seed, and within the limits of experimental error in the analyses, these tests gave constant results. The oil had an average iodine value of 111.0 and an average saponification number of 193.1. The percentage of free fatty acids was determined on the samples of oil, and all of the samples showed the presence of no free fatty acids.

RELATION OF LENGTH OF LINT TO OIL CONTENT OF SEED

The results were studied to see if there is any relationship between the length of lint and the oil content. The averages are given in Table 6.

Table 6.—Relation of length of lint and percentage of oil in the seed.

Length of Lint in Inches	Per Cent of Oil
1-1/8	14.77
1-1/16	16.02
1	16.28
15/16	16.00
7/8	16.50
3/4	15.70

The varieties of cotton having a length of lint between $\frac{7}{8}$ and 1-1/16 inches had the greatest oil content. However, some of the varieties of short and long staple will have a high oil content.

RELATION OF VARIETY OF SEED TO OIL CONTENT

The weight of one hundred seed, the percentage of hulls and the percentage of meats, were averaged for the samples of each variety and the averages are given in Table 7.

Table 7.—Relation of variety to chemical composition of seed.

Variety	Weight of 100 Seed, Grams	Per Cent Hulls	Per Cent Meats	Per Cent Oil	Per Cent Protein
Acala	10.45	47.37	52.63	16.65	27.55
Burnett	8.44	49.64	50.36	16.39	28.47
Cleveland	8.88	49.08	50.92	15.25	27.30
Delfos	8.65	51.92	48.08	15.19	27.82
Half and Half	9.01	45.74	54.26	17.29	29.40
Lone Star	10.65	51.13	48.87	15.87	27.85
Long Staple Average	9.19	51.06	48.94	15.43	27.61
Mebane	9.97	49.51	50.49	16.18	28.15
Rowden	11.17	51.28	48.72	15.46	27.10

Table 7 shows that on an average the variety having the lowest percentage of hulls and the highest percentage of meats will have the greatest amount of oil, regardless of the size of the seed. This is due in part at least to the fact that the oil comes from the meats and not from the hulls. Acala, Burnett, Half and Half, and Mebane are the varieties having the greatest amount of oil.

Table 8.—Detailed results arranged by variety.

	Weight of 100 Seed, Grams	Per Cent Hulls	Per Cent Meats	Per Cent Oil	Per Cent Protein
Acala:					
Acala 8606	9.67	51.20	48.80	16.28	26.9
Acala 8609	11.64	47.00	53.00	18.50	28.2
Burnett:					
Burnett	7.64	48.54	51.46	17.60	29.3
B–9–1	9.42	50.39	49.61	15.09	29.0
Westex	8.29	50.00	50.00	16.50	27.1
Cleveland:					
Cleveland	9.14	49.58	50.42	16.06	28.2
Piedmont	9.53	49.86	50.14	12.86	27.9
Wannamaker 9101	7.98	56.70	43.30	10.64	23.4
Wannamaker 9109	9.12	43.67	56.43	19.30	29.7
Delfos:					
Delfos 8602	8.59	51.18	48.82	16.93	27.5
Delfos 8603	8.66	49.80	50.20	14.99	28.7
Delfos 9102	8.21	54.82	45.18	14.46	27.1
Delfos 9107	8.17	51.87	48.13	14.39	28.0
Half and Half:					
Half and Half 8604	9.51	44.47	55.53	16.00	29.9
Half and Half 9096	8.52	47.02	52.98	18.58	28.9
Lone Star:					
Lone Star 8590	9.73	56.00	44.00	15.34	24.9
Lone Star 9131	12.38	50.45	49.55	16.14	28.2
Lone Star 9132	11.99	52.84	47.16	14.96	26.1
Lone Star 9133	11.46	48.49	51.51	17.02	28.5
Lankart	11.33	50.91	49.09	16.37	28.1
Startex 333	9.82	50.61	49.39	15.66	27.9
Startex 333	10.35	49.18	50.82	17.00	29.3
Startex 333	8.90	51.97	48.03	15.20	28.6
Russell	9.89	49.72	50.28	15.33	29.0
Longer Staple:					
Delta Type Webber	8.52	52.23	47.07	14.90	28.7
Express	8.66	49.90	50.10	16.28	27.4
Lightning Express	8.88	51.59	48.41	14.41	27.7
Lightning Express	7.79	52.63	47.37	14.38	26.7
Snowflake	10.55	48.52	51.48	18.57	27.0
Wacona	10.73	50.82	49.18	14.05	28.1
Mebane:					
Anton	10.57	46.77	53.23	16.48	30.3
Cliett	9.25	52.00	48.00	15.30	27.9
Harper	10.87	50.92	49.08	15.15	29.1
Kasch	10.10	50.81	49.19	15.56	28.1
Mebane 804	9.72	47.49	52.51	17.78	29.1
Mebane 4120	9.60	48.23	51.77	15.38	29.4
Mebane 9105	8.59	49.62	50.38	17.58	27.5
Mebane 9113	8.75	47.59	52.41	17.17	28.3
Mebane 9135	12.00	48.40	51.60	17.03	28.6
Mebane (Blue Wagon)	11.93	51.55	48.45	15.02	26.2
Mueck	10.24	53.13	46.87	15.54	26.1
New Boykin 8599	8.44	52.30	47.70	14.58	26.2
New Boykin 9134	9.39	45.60	54.40	17.80	29.1
Rowden:					
Belton	11.74	50.52	49.48	14.48	27.9
Rowden 8613	9.86	53.64	46.46	15.36	26.3
Rowden 9128	11.82	48.95	51.05	16.02	27.8
Rowden 9128	12.09	48.67	51.33	16.70	28.6
Sunshine	9.76	54.61	45.39	14.74	24.9

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SUMMARY AND CONCLUSION

1. Analyses were made of the meats, hulls, and oil from 73 samples representing as many varieties and strains of cotton grown on the Main Station farm of the Texas Agricultural Experiment Station at College Station.

2. No relation was found between the weight and size of the seed and the percentage of oil in the seed.

3. No appreciable variation was found in the index of refraction, the iodine number, and the saponification number, of the oil from the different varieties of seed.

4. Varieties of cotton with lint $\frac{7}{8}$ to 1-1/16 inches in length had slightly higher content of oil in the seed than did those with either shorter or longer staple.

5. On an average, seed with the highest percentage of meats contain the highest percentage of oil.

6. The average oil content in the seed of 9 different groups of varieties consisting of 73 samples is tabulated. Half and Half was the highest, Delfos the lowest.

7. The work covered only one season, and the conclusions are considered as tentative pending further investigation. The results are being published because of their emphatic suggestions.

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